

Tenneco Minerals
A Tenneco Company

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DOGM
MINERALS PROGRAM
FILE COPY

August 7, 1991

Approved
Oct 23/91
DOGM

Mr. Larry Gore, Geologist
United States Bureau of Land Management
Dixie Resource Area Office
225 North Bluff Street
St. George, UT 84770

RECEIVED

AUG 19 1991

Reference: Amendment to Plan of Operations

DIVISION OF
OIL GAS & MINING

Dear Mr. Gore:

Enclosed please review the amendment to Tenneco Minerals Company's existing Plan of Operations for the Goldstrike Mine.

In addition, TMC's monitor well summary and groundwater investigation plan have been included as supplements to this draft revision.

This amendment is to acknowledge the inclusion of six (6) groundwater monitor wells (MW 1-6) located on lands administered by the BLM but within TMC's operations scope.

Please advise me of any concerns.

Sincerely,

TENNECO MINERALS COMPANY

Ken A. Kluksdahl
Mine Manager

KAK:bas

Enclosure:

BUREAU of LAND MANAGEMENT
DIXIE RESOURCE AREA

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BACKGROUND

On February 28 to March 1, 1991, the Goldstrike Mine received 6.28 inches of precipitation over a 41-hour period. This rainfall event exceeded the design retention capacity of the mines solution storage ponds.

Recognizing that an overflow event was eminent, Tenneco Minerals personnel initiated solution neutralization and a controlled discharge. Two discharges were conducted: the initial discharge occurring on March 1, 1991 (37.5 hours) and the second discharge occurring on March 4, 1991 (11.75 hours). Sampling results of the discharged solutions indicated low to non-detectable free cyanide levels. Later, independent analyses confirmed low to non-detectable values for total cyanide and various other elements.

Following the discharge event, the Goldstrike Mine suffered flyrock damage to two of the operations ponds (fresh water and barren solution ponds) on March 6, 1991. In both cases, the primary FML was damaged and solutions were in contact with the secondary clay liner.

In both incidents, Tenneco Minerals Company moved swiftly and responsibly in neutralizing the solutions that were discharged and in effecting pond repairs as expeditiously as possible.

However, Tenneco Minerals with the Utah Bureau of Water Pollution Control recognized that groundwater investigations were necessary to ensure the environmental impact was negligible.

In an effort to rapidly ascertain the potential groundwater impact, Tenneco Minerals initiated drilling at seven locations downgradient from the process plant area. In addition, one upgradient well was drilled to the east of the plant site near the Quail Spring/Arsenic Gulch confluenc.

Drilling Operations

Monitor wells drilled and completed at the Goldstrike Mine consisted of the following operations:

1. Drill hole locations were identified, 5-3/4 inch diameter drill holes were drilled with a reverse circulation drill rig.
2. Cuttings and drillers logs were noted for any in-hole water encountered (depths logged).
3. Drill holes were drilled to producing water zones (water could be air-lifted) or 500 feet total depth.

4. Drill holes were then logged with a neutron logging machine (to gauge potential water zones).

5. Well completions were initiated with a 2 inch pvc stand pipe with slotted section installed at the water bearing horizon. This area was sand packed with 100 mesh silica sand. Horizons above and below the water zone were sealed with a bentonite cement mix (1:12) ratio. All drill holes were collared with a 7 foot section of 6-7/8" diameter steel casing and capped.

Monitor Well Locations

Sites for monitor wells 1-8 (excluding well 6) were determined based upon hydrologic interpretation of the generalized groundwater potentiometric (down gradient) trend from the process plant, of overall geologic interpretation of potential water-bearing zones, and at key drainage confluence points. The UBWPC reviewed these sites and concurred with the locations.

Monitor well 6 was positioned above the plant site but near the Quail Canyon/Arsenic Gulch confluence as a future monitor well to the leach-pad 2 extension in Quail Canyon.

Disturbance

Monitor wells 1-4 were drilled adjacent to the plant site in previously disturbed ground. Excluding the wells, there was no additional disturbance as a result of the drilling activities. Monitor well 5 was located and drilled 30 feet northwest of the existing county access road near the East Fork of Beaver Dam Wash. A drill pad site of less than .25 acres was disturbed.

Monitor well 6 was located and drilled off an existing exploration road east of the East Hamburg pit. This road was lengthened 200 feet. Total disturbance for the road and pad was .4 acres.

Monitor wells 7 and 8 were drilled on private land below the sediment dam and at the Arsenic Gulch confluence. No additional disturbance was created as a result of these two wells.

Reclamation Cost Estimate

A reclamation cost estimate was developed and included:

A. Capping/sealing of the wells which will involve pulling the casing, severing the pvc well, grouting the water zone, a 50 foot buffer zone and a 5 foot surface plug and covering with topsoil.

B. Reclamation of monitor well site 5 which will involve some minor grading, mulching and seeding of the well site in addition to the well capping.

C. Reclamation of well site 6 which will involve grading, recontouring, mulching and seeding of the well site and a 200 foot access road (in addition to the well capping).

D. Seeding, mulching and fertilization which will all be done in accordance with the approved Plan of Operations.

The total cost estimate to complete this work is \$5,400.00. Tenneco Minerals Company's current bond estimate as identified in the DOGM revised NOI is \$1,104,000. Tenneco Minerals Company is currently bonded for \$1,200,000.

COST CALCULATION SHEET

1. Monitor Well Capping/Well Collar Removal

A. Required to grout water zone +50' either side and 5' plug at surface.

B. Well amounts:

<u>Well</u>	<u>Zone</u>	<u>+</u>	<u>50'</u>	<u>+</u>	<u>Cap</u>	<u>Total</u>
MW-1	(Total 54')					54'
MW-2	(Total 54')					54'
MW-3	20'		50'		5'	75'
MW-4	10'		-			
(Dual Completion)	20'		50'		5'	85'
MW-5	30'		50'		5'	85'
MW-6	60'		50'		5'	115'
MW-7	50'					
	40'		50'		5'	145'
MW-8	30'		50'		5'	85'
Total =						700'

C. Well service rig at 2.5 days = \$2,500.00
with two (2) operators
(includes mobilization)

D. Materials \$2,000.00

Total = \$4,500.00

2. Recontouring/Grading

A. Road \$1.50/lf x 200/lf = \$ 300.00

B. Pads \$1.50/lf x 100/lf x 2 = \$ 300.00

Total = \$ 600.00

3. Mulch, Fertilizer and Seed

A. Total/ac = \$430 x .65/ac = \$ 300.00

Grand Total = \$5,400.00

1991 MONITOR WELL SUMMARY

DEPTH AND SCREENING DETERMINATIONS

The following is a brief summary of depth and screen interval determinations for 1991 monitor wells. Details are provided on the geologic log and completion record for each hole.

MW9101, MW9102, MW9103

Location: Plant/Process Pond Area

Three monitor wells were drilled immediately west of the plant/process pond area. Two (MW9101, MW9102) were designed to test for water flow at the fill/bedrock interface, one (MW9103) tested a potential aquifer under the pond area.

MW9101 - Drilled to bedrock contact at 42 feet, deepened to 54 feet T.D. (total depth). A .01" slotted screen was placed from 8 feet above bedrock to 2 feet below. Capped blank PVC was placed 44 to 54 feet to allow a reservoir for sampling. No water was noticeable when drilled.

MW9102 - Drilled to bedrock contact at 54 feet, deepened to 66 feet T.D. A .01" slotted screen was placed from 8 feet above bedrock to 2 feet below. No water was noticeable when drilled.

MW9103 - This hole was collared in bedrock. The intent of the hole was to test for water in a potential aquifer of fractured limestone interbeds, whose outcrop trace projects into the general area beneath the process ponds. The hole was drilled to 80 feet. A 20 foot screen was placed from 38 to 58 feet to "bracket" fractured limestone interbeds. No water was noticeable when drilled.

MW9104

Location: Toe of Process Pond Area Fill

This hole was drilled to a depth of 500 feet on the recommendation of Matt Croft, UBWPC. A small influx of water was airlifted from sample interval 70-75, water influx increased to 90 feet. The hole then dried off as drilling progressed. No additional influx of water was noted to 500 feet. After neutron logging, the hole was backfilled and plugged at approximately 100 feet to prevent migration of water higher in hole to lower strata. Screen was placed from 83 to 93 feet and sand from 80 to 91 feet. The screen was intended to be placed to 70 feet or above but wasn't through miscommunication. The hole was grouted to approximately 52 feet by the end of the shift. At the start

of the shift the following day, significant water was standing on the grout placed around the blank PVC. This was inferred to be water coming into the hole above the level detected in drilling. A second completion was made in the same hole with screen placed from 22 to 42 feet. Sand was placed from the existing grout level at 52 to 18 feet, and the hole was grouted to the surface.

MW9105

Location: East Fork Beaver Dam Wash, East of Confluence with Arsenic Gulch

Drilled to total depth of 385 feet on recommendation of 400 feet by Matt Croft, UBWPC. There was water in the hole at approximately 35 feet near gravel - bedrock contact. Airlift was estimated at 20+ gpm. There were hole caving problems from collar to 90 feet; no noticeable increase in water from 90 to 385 feet T.D. The hole caved at 90 feet when tripping. Water at 35⁺ level was streaming into the hole (through caved area apparently, as hole did not fill to static level). The hole was plugged with bentonite at approximately 90 feet. Several yards of gravel were dumped into an apparent cavity from 60 to 90 feet. Screen was placed from 30 to 60 feet and sand was placed from 40 to 60 feet. Blank PVC was placed from 60 to 70 feet as a reservoir for sampling.

MW9106

Location: Quail Canyon East of East Hamburg Pit

Drilled to a total depth of 500 feet on the recommendation of Matt Croft. There was dampness at the interval from 340 to 360 feet. No water could be airlifted but drill string was wet when tripped. The hole was backfilled to 400 feet and plugged. Screen was set from 320 to 380 feet and sand was placed from 300 to 395 feet. 20 feet of blank PVC was set from 380 to 400 feet for a reservoir for sampling.

MW9107

Location: Below Toe of Sediment Dam

Drilled to a depth of 300 feet. Water within this depth was adequate for testing. Hole was terminated to prevent water migration to lower levels if perched. In drilling, dampness was noted at 130-135 feet with water at 160-175 feet. Airlifted water was estimated at 8 gpm. At

250 feet a small increase of water was noted. Upon completion, a neutron log suggested 15 feet of water was standing in the hole. Water could be heard streaming in the hole several hours after tripping. The hole caved at 285 feet. It was proposed to have a double completion in this hole, one from 150 to 200 feet and one from 230 to 270 feet to allow isolated sampling from different depths. During completion, screen was placed from 216 ft to 256 feet and sand was placed from 216 to 266 feet. Bridging occurred at 120 feet when bentonite was being placed on top of the sand. Rather than aborting the well, a plug was established at 120 feet and the well was grouted to the surface with the single screened interval.

MW9108

Location: West of Arsenic Gulch, Below Sediment Dam

This hole is a re-entry of a water test well drilled in 1988, which was a re-entered exploration hole drilled in 1986. Matt Croft suggested this hole be re-entered and neutron logged to 700 feet. When drilled initially as a water test well, this hole encountered water at 103 to 105 feet, water volume increased slightly to 240 feet and then began to decrease. It was inferred that water was being produced from a fractured limestone bed from approximately 90 to 140 feet and no significant water was contributed from deeper in the hole.

When re-entered as a monitor well, no water could be airlifted but cuttings were damp around 120 feet. The hole was re-entered to approximately 650 feet, then abandoned because of high torque on the drill string. The hole caved at approximately 150 feet upon tripping from the hole. The well was plugged and screen set from 110 to 140 feet. Sand was placed from 100 to 140 feet on a cement/bentonite plug to prevent down-hole migration of this inferred perched aquifer. No neutron log was attempted because of hole instability and the caving at 150 feet.

J.P. Helant